

ABSTRACT

This invention relates to a novel process for sustainable CO₂-free production of hydrogen and carbon by thermocatalytic decomposition (or dissociation, pyrolysis, cracking) of hydrocarbon fuels over carbon-based catalysts in the absence of air and/or water. The process is applicable to any hydrocarbon fuel, including sulfurous fuels. Combination of a catalytic reactor with a gas separation unit allows to produce high purity hydrogen (at least, 99.0 v%) completely free of carbon oxides. In a preferred embodiment, sustainable continuous production of hydrogen and carbon is achieved by both internal and external activation of carbon catalysts. Internal activation of carbon catalyst is accomplished by recycling of hydrogen-depleted gas containing unsaturated and aromatic hydrocarbons back to the reactor. External activation can be achieved via surface gasification of carbon catalysts by hot combustion gases during catalyst heating. The process can conveniently be integrated with any type of fuel cell.

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